

Chapter 5

EXCAVATION CONSTRUCTION REQUIREMENTS

General Preparation

Prior to beginning excavation, grading, or embankment operations in any area. The following items must be completed:

- * Clearing and grubbing as outlined in an earlier chapter, will be performed. This includes the removal of all perishable material such as tree roots, stumps, sod, weeds, agricultural debris, etc.

- * Check sections will be taken and checked satisfactorily with those on the plans. On contracts with construction engineering it is the responsibility of the contractor to secure check sections. The method of checking original cross sections is outlined in the General Instructions to Field Employees Section 3.

- * After the previous items have been completed the contractor will proceed with scalping in areas where excavations are to be made, or embankments are to be placed. Another common term for scalping is stripping. Scalping is the removal of the upper 4" of the soils. Removal is necessary to insure that decayable vegetation is not incorporated into an embankment. Although 4" is to be a maximum, top soils containing large quantities of humus to a depth greater than 4" will be removed until suitable materials are exposed. Scalping will be completed to the limits of the area where excavations are to be made or embankments are to be placed. The grading operations will be inspected closely for unsuitable material. Roots and other large perishable objects should be removed and piled outside of the construction limits for later disposal.

- * All pronounced depressions left in the original ground surface by removal of objectionable material from within embankment limits will be filled with acceptable material and compacted to the density require for the embankment. The upper 6" of the original ground will be compacted with a roller weighing no less than 10 tons, or with other approved compacting equipment.

- * The final step before embankment placement is proofrolling. The work will be performed with a pneumatic tire roller minimum tire size of 7:50 by 15 in accordance with 409.(d) other approved equipment such as fully loaded tri-axle dump truck may be substituted for the pneumatic tire roller. There will be one or two complete coverages as directed. Roller marks, irregularities, or failures will be corrected. This procedure will also reveal all spongy and yielding materials which are not compacted. These materials within the proposed embankment will be

removed. The locations of spongy and yielding material may be detected visually. During proofrolling the pneumatic tire roller will often leave severe ruts in the grade indicating either yielding areas or unstable material. These locations may also be detected audibly. During proofrolling the engine of the roller will have a consistent sound if rolling solid grade. When an unstable area is encountered the engine will labor in order to pull the roller through the spongy area. After proofrolling has been completed and all soft or unstable areas have been corrected, the area is ready for placement of the new embankment.



General Requirements

Excavated material that is suitable for embankment construction is placed in the embankment before placing any borrow material. This means that ditches should be excavated first, since much of common excavation is derived from ditch cuts. The construction of ditches first also provides drainage for the embankment area. The roadway embankments should be maintained higher at the center to promote drainage of the roadway.

Once ditches have been completed the contractor will begin placement of temporary erosion control devices as soon as possible. Failure to do so may cause pollution to drainage ditches, streams, and rivers adjacent to the project. There are several different types of temporary erosion and sediment control devices. A list of the different types include:

- ☐ Perimeter protection
- ☐ Drainage barrier at swale
- ☐ Slope protection - interceptor ditches and slope drains

- ❑ Sediment control in side ditches - straw bale ditch check, riprap ditch check, ditch sediment trap, or culvert pipe protection.
- ❑ Sediment basin
- ❑ Inlet protection - Curb inlet protection and drop inlet protection

Section 205 of the Standard Specifications and Standard Drawings.

These erosion control features will be maintained until permanent erosion control features are placed. The need for erosion control devices is determined in the planning stages of the project, and erosion control devices are outlined and detailed on the construction plans. Additional controls may be required to meet field conditions. The technician is responsible for ensuring that these devices are being maintained as well. Inspection of control devices is especially important during and after periods of rainfall which may cause damage to the devices. Sediment basins need to be cleaned, dikes or dams reconstructed, and straw bales replaced, if damage has reduced the effectiveness of these devices.

During the construction of an embankment, each lift being placed has certain factors which must be considered:

- * Lifts should extend transversely over the entire embankment area between slope stakes. Doing this insures that the outside slopes of the embankment are compacted as well as the middle of the embankment. The higher the fill, the more critical this becomes.
- * The fill width should be checked as the fill progresses. Failure to do so may cause fat or bellyed slopes.
- * Fat slopes are slopes which contain excess material, or exceed the planned slope. Fat slopes cause extra work in computing pay volumes.
- * Bellyed slopes are slopes that do not contain enough material. This is detected by viewing the the slopes longitudinally. Bellyed slopes need to be corrected as the embankment is being built. Sidecasting should be avoided as a solution since this usually develops a fill slough or slide at a future date.

Equipment Requirement

The equipment required for placing embankment consist of basically four categories.

- * Hauling Equipment.
- * Spreading Equipment.
- * Compacting Equipment.
- * Moisture Control Equipment.

Hauling Equipment

The method of hauling embankment material is determined by the contractor. His decision will be based upon the following construction factors.

- * Type of material.
- * Source of material.
- * Conditions or obstacles between the source and area of placement.
- * Availability of equipment.

The equipment used for hauling includes:



- * Dump trucks
- * Earthmovers
- * Quarry trucks



Earthmovers are the most frequently used of the three. There are various sizes and models. Some are self-loading and convenient for smaller projects. Earthmovers are used in excavating, hauling, and placement of soil materials that are adjacent to or on the project. When common excavation must be hauled across a bridge structure, or when borrow material is obtained from a remote source dump trucks are used. Quarry trucks are used only in rock excavation.

Spreading Equipment

Because embankments are to be constructed in uniform layers, spreading equipment is necessary. Placing uniform layers can be done with several types of equipment or groups of equipment. The most common are the motor grader and the bulldozer. If soil conditions are suitable earthmovers may also be considered as spreading equipment. This is accomplished by the earthmover operator controlling the discharge of the materials in such a manner to create a uniform layer. Because soil conditions can change dramatically the earthmover should not be considered the only spreading device necessary.

Another method of leveling layers uses a sheepfoot compactor with a blade. This piece can be used in lieu of a motor grader. This is especially true on

small grading projects.

SPREADING EQUIPMENT



A piece of equipment that may also be used during the spreading operation is the disc. Although it does not level, it is helpful in creating a uniform layer. The disc is used for:

- * Breaking up lumps, slabs, and clods.
- * Aerating material to remove excess moisture.
- * Incorporating water to increase moisture.

Compacting Equipment

Compacting equipment requirements vary from project to project. A list of the types of compactors which are most commonly used include:

- * Three wheel roller
- * Smooth drum vibrator roller
- * Vibratory tamping roller
- * Static tamping roller or sheepsfoot
- * Crawler-tread equipment or bulldozer
- * Mechanical tamps or vibrators

The compactor to be used is determined by the contractor and is dependent upon several factors:

- * Size of embankment.
- * Type of materials being compacted.
- * Conditions of materials being compacted.
- * Availability of equipment.
- * Contractor's preference.

For placement of granular embankment material, three wheel and smooth drum vibrator rollers are preferred over tamping rollers. A dozer may be used in areas not accessible to conventional rollers, in building surcharges for peat excavation, or for rock embankments. Tamping vibratory rollers are preferable for shale embankment.



For placement of a clay soil embankment material, large slabs, lumps, or clods must be broken up before compacting. Breaking may be accomplished by disking, but often a sheepsfoot roller will work on clods and low moisture lumps.

The following chart may be helpful in determining which compactors may be used for different materials.

Compactor Type	Material	Lift Depth
3 Wheel	all soils	8" max.
Smooth Drum Vib	all soils	8" max.
Tamping-foot	soil or shale	Length of tamping foot
Crawler-tread	rock	See specs.
Crawler-tread	aggregates*	6" max.
Smooth drum vib	aggregates*	6" max.
Mechanical tamps or vibrators	soils	6" max.
Mechanical tamps or vibrators	aggregates	4" max.

*Where impractical to perform density tests.

Remember that whatever equipment is used for compacting, the goal is a uniform dense embankment.